Work and Energy

Work

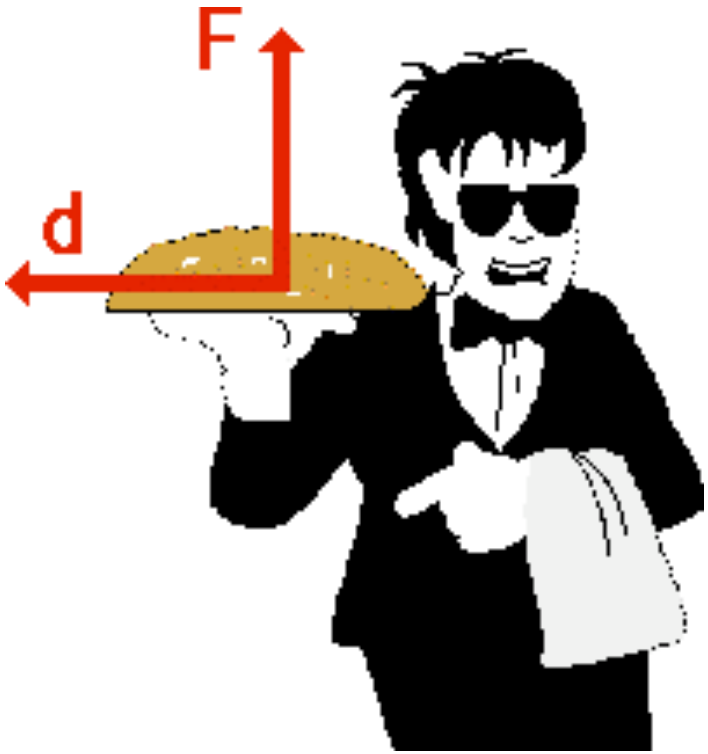
Define work done on an object by a force as

(Work) = (Force) X (Distance)

Force acting in direction of motion: Positive work.
Force acting in opposite direction: Negative work.
Force perpendicular to motion: Zero work

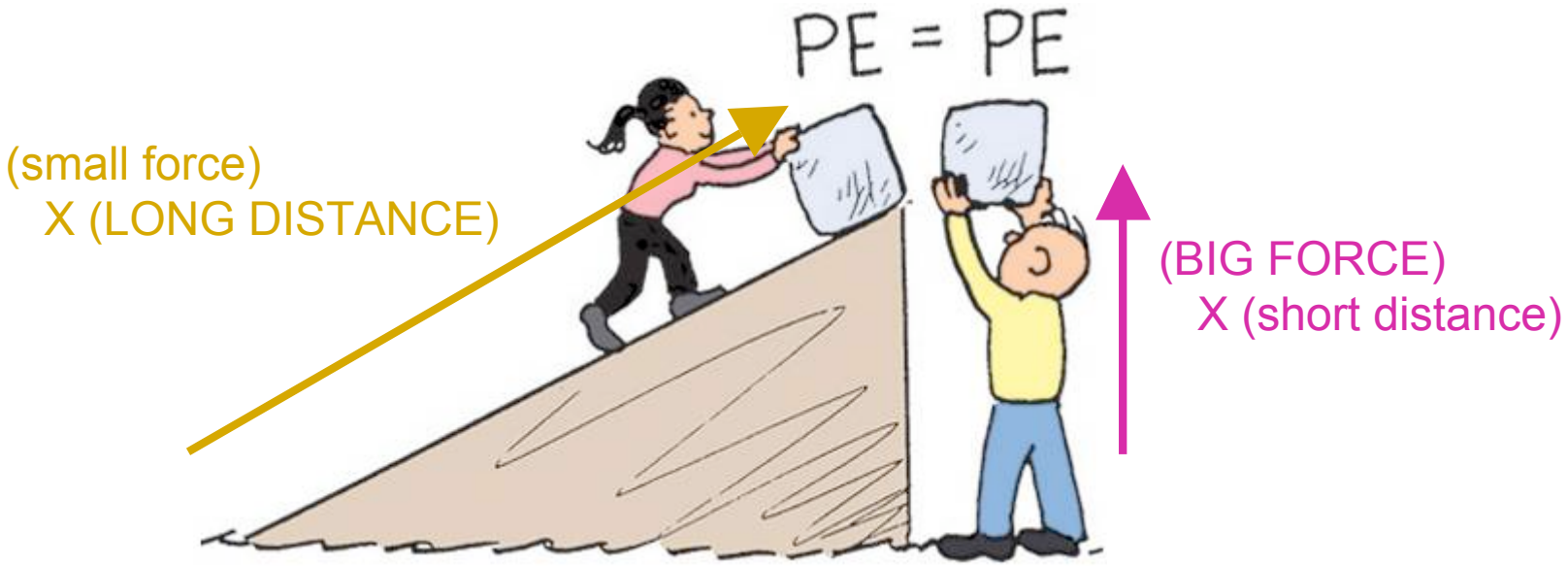
Is any work being done on the food as the waiter carries it?

No! The force is perpendicular to the displacement!



Work & Energy

When forces do work on an object, the work done equals the change in energy.



Two persons do the same work in different ways.

Sample Problem

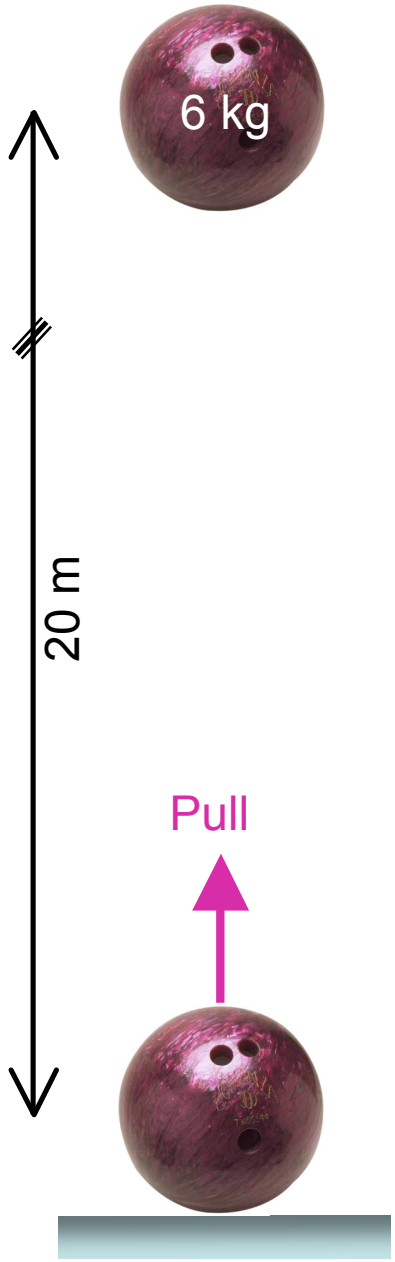
How much work do you do in lifting a 6 kg bowling ball a distance of 20 meters by pulling up with a force equal to its weight?

Since weight is 60 Newtons, work done on the ball is

(Work) = (Force) x (Distance)

= (60 N) x (20 m)

= 1200 Joules



Work units!

- The units used to measure work are Joules
- 1 Joule (J) = 1 N-m

Power

How quickly work gets done

- Work is independent of time
- Anyone can do a lot of work. Some may take longer than others
- Power is the rate at which work gets done.
- Power = $\frac{\text{(work)}}{\text{(Time)}}$

- Power is inversely related to time.
- More time = less power

- The unit for power is the Joule/second.
- To shorten this, we call it a “Watt”. Named after James Watt.
- In America, we measure power in “horsepower”. Where 1hp = 746 Watts